University of Bedfordshire

# ASSIGNMENT TOP SHEET

## Faculty of Creative Arts, Technologies & Science

### Department of Computer Science & Technology

| | |
|---|---|
| Student Ref. No 1110188 | Unit Code<br>**CIS000-6** |
| Unit Name<br>Computer Animation and Games Technologies | Deadline for Submission(s)<br>**21st September 2012** |
| Student's Surname<br>Simons | Student's Forename<br>Alain |
| Unit Leader's Name<br>**Dr Fiaz Hussain** | Supervisor's Name<br>**Professor Edmond Prakash** |

**Assignment Details:**

**MSc Project – Final Thesis Report**

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**Alain Simons**

1110188

# 3D animation visualization on commercial websites

MSc Computer Animation and Games Technologies

Masters Thesis Report

Department of Computer Science & Technology

Dr Edmond Prakash

# 3D animation visualization on commercial websites.

*In conjunction with the ISPN-system.*

A research after the 3D animation possibilities on the World Wide Web and why it's still not common practice on websites.

21-09-2012

## Abstract

3D technology became more and more a part of our live. Often we even don't know it. 3D technology can be found back in medical applications, cinematographic, automotive design, etc...

Only one technology seems to have missed the 3D train, namely the World Wide Web. Internet is still not overwhelmed with 3D content, still and animated. This project analyses the reasons, bottlenecks why 3D technology is so slow in conquering the World Wide Web. The research is focused on 3D visualization in commercial websites.

Research is done after the difficulties to include 3D content in a HTML environment. By involving a complete website solution, the ISPN-system, a realistic and immersive environment is setup to research where and what kind of issues may occur.

The development of the ISPN-system could be a case on his own eventual done in another Msc project or a PhD project. Main goal of the ISPN-system is to provide decent footage material (visual and data) to graphic designers and website developers. An inquiry will be conducted whether this has some sense.

## Acknowledgements

Many thanks go to my supervisor Professor Edmond Prakash who gave me many tips how to work out the dissertation. Edmond was also an inspiring source for finding extra information about the subject of the dissertation.

Secondly I want to thank Thijs Proost for his advice on methods to put images into a database and of course getting them back out.

Also the support from my wife Anja and daughter Amélie should not be underestimated.

And Jean Wintermans who believed I could succeed the Msc project.

Many thanks to them all !

## Thesis author consent form

**AUTHOR'S NAME:** ALAIN SIMONS

**TITLE OF THESIS:** 3D ANIMATION VISUALIZATION ON COMMERCIAL WEBSITES.

**DEGREE:** MASTER IN COMPUTER SCIENCE

I have read and understood the University's regulations and procedures concerning the submission of my thesis.

I understand that I have already signed a declaration agreeing to my dissertations being kept in the Learning Resources Centre (LRC) when I enrolled.

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## Chapter I

# CHAPTER I

# INTRODUCTION

## 1.1 Background study

### 1.1.1 Product representation in the past on commercial websites.

Until now most 3D commercial websites show 2D image material both still images and animations. Let's say it's still an inheritance of the old school Adobe Photoshop/Flash environment. Most content on the web consists of text data, 2D pictures, 2D movies which information can be collected in a database. With CMS (Content Management Systems) pictures, numeric and textual data can be stored in an easy way into relevant databases. Scripting languages such as php and Python are used to get data in and out of the database.

### 1.1.2 3D gets involved in product representation on the web.

The technology for displaying 3D on the web is relative old. A much used technology, X3D is built on VRML (Virtual Modelling Language) which is already an international standard from 1997 on. Same story for WebGL which is a binding between JavaScript and OpenGL which also exists from the nineties. Reason why 3D on the web wasn't successful lies in the difficulties to bind them with HTML. OpenGL needed JavaScript and the HTML canvas tag to get on. X3D didn't need this but in this case a plug-in was needed to display 3D content. Now there's a choice between a plugin, or view 3D content in a 3D enabled browser. In fact the canvas tag and JavaScript opened the doors for 3D to the web.

### 1.1.3 Current situation, problem definition

There're a lot of technologies available to generate 3D content for the web but somehow it doesn't seem to work out. It's also hard to find any statistics about the use of 3D on the internet. A sign on the wall? Specifications for the use of WebGL and X3D are defined several years ago now. Next to X3D and WebGL there're also other solutions like X3DOM, Jav3D, XML3D, etc… to quote a few. But they are all based on technology used by WebGL and/or X3D. First research with result are done with X3D and WebGL. But what's going on? Why there's not more 3D content on the web? Is it too difficult for web developers to get it working, is the delivered content a problem? What about game engine solutions, can they be involved in displaying 3D content for commercial use?

## 1.2 Overview dissertation

Most important aim of this dissertation is to show if it's easy to integrate 3D content in a HTML environment. If there are any obstacles to define them and try to find out a solution or workaround. To do so next shortlisted tasks were carried out:

- Setup of an web based solution, ISPN-system.
- Case study webservers.
- Case study web databases.

- Case study 3D solutions for still images and animation on the web.
- Case study of existing implementations.
- Blueprints of proposed systems, ISPN-system and 3D convertor.
- Implementation and testing systems.

## 1.3 Aims and objectives

### 1.3.1 Aims of Msc project

- Suggest a framework for manufacturers to distribute their product information for commercial use through the World Wide Web.
- Framework includes a suggestion for a tool to convert 2D to 3D information.
- To stimulate the use of 3D and 3D animation on the World Wide Web.

### 1.3.2 Objectives of Msc project

#### 1.3.2.1 Surveys

Two kinds of surveys will be used for the Msc project. The first is an interview survey where a selected group of persons will be interviewed about the viability and usefulness of the proposed system. For this a selection of people with the necessary credentials are looked after. They also have to represent a target group. These target groups are:

- representatives of manufacturers.
- academics.
- graphic designers and website developers.

A specific questionnaire containing aims and objectives will be made separately for each group and presented at an interview or send by email after contacted them. Goal is to test if the basic structure of the system is sound and if adding 3D content (and the use of a 3D convertor) is an extra value for the system.

The second survey is an user survey hosted on the website of the system itself. To gain confidence of the user, the user can do the survey on the systems website. No external survey website will be used. Goal is to get information from the end user after he has used the solution to add 3D content to improve usability of the product.

#### 1.3.2.2 Website hosting and setting up website

The ISPN system should be accessible for every user around the world so a web based application will be the preferred way to use. A physic website needs to be set up to host the system. The domain name ISPN-system has to be registered by a domain registrar and space on a webserver has to be hired.

#### 1.3.2.3 Setting up database

To maintain data a database system is needed. This database has to be accessible by the website of the system. For this a script language to transfer data from webpages to a database and vice versa is needed.

#### 1.3.2.4 3D generator tool

Several options are available to develop an online 3D generator tool. Main goal is not to use a third party solution for which fees has to be paid. At least two solutions will be compared to each other by trying to create an artifact of each. This to show it's possible, like others also did, to get 3D on the web starting from almost zero knowledge.

## 1.4 Methodologies and outcomes

### 1.4.1 Methodologies

Following methods are used to analyze problems:

- Case studies to get informed about the used technologies for:
  - Web development.
  - Web databases.
  - Web 3D.
- Surveys
  - Initial survey at start project.
  - Product survey at the end of the project.
- Framework
  - Setup algorithm system.
- Blueprints
  - Visualization framework.
  - Previews.
- Implementation
  - Work out blueprints in framework.
  - Testing framework.
- Primary research
  - Surveys, personal interviews, survey by mail.
  - Field trials attendance .
- Secondary research
  - iEEE, ACM journals papers.
  - Books, websites official organizations.

### 1.4.2 Outcomes

- A report with a decent overview of available techniques to use 3D animations on commercial websites.
- A survey indicating the use of 3D animation on commercial websites is wanted or not.
- Comparison between frameworks different 3D technologies.

Workflow project

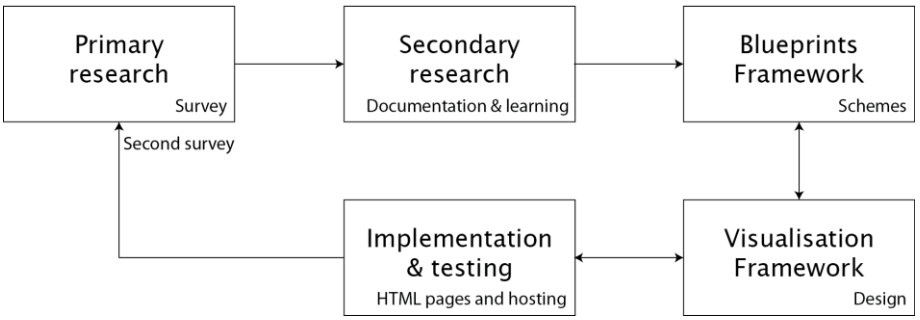



Figure 1: overview different parts covered in this dissertation.

## 1.5 Planning the dissertation

### 1.5.1 Planning/agenda interviews

Interviews were planned to take place at the start of the project. This wasn't possible for every contender of the survey, so they had to be done on a later date. Earlier interviews were asked to fill in a an upcoming survey.

This is a list of interviewee. In the appendix can be found back a short notice of there comments during the interview. Interview were done in person or by phone.

**Graphic designers and website developers:**

- Luc Matthyssen (Graphic designer, website building, publisher Kontakt, Belgium)
  - 10 July 2012.
- Chris Seuntjens (Graphic designer, senior manager dtp, Concentra printing, Belgium)
  - 11 July 2012.

- Stijn Dieltjens (Publicity senior manager, shopping center Hens, Belgium)
  - 8 August 2012.

- Arne Van Lommel (Design for screen printing, director Arva-shop, Belgium)
  - 7 August 2012.

- John Allpaerts (Publicity agency, director Amco Group communication, Belgium)
    - 28 August 2012.

**Academics:**

- Marc Van Olmen (Development Manager, Acclivity NYC LLC, New York, USA)
    - 4 July 2012.

- Patrick Van Houtven (Senior lecturer University college Artesis, Antwerp, Belgium)
    - 4 September 2012.

- Eric Sieben (Senior lecturer University college Artesis, Antwerp, Belgium)
    - 3 July 2012.

- Liesbeth Boeckx (Msc student Computer Science, University of Bedfordshire, Luton, UK)
    - 30 August 2012.

- Marc Proesmans (Researcher, University of Leuven, Leuven, Belgium)
    - 31 August 2012.

- Paul Sant (Lecturer, University of Bedfordshire, Luton, UK)
    - 10 July 2012.

- James Stevenson (Researcher, V&A Photographic Studio, London, UK)
    - 19 August 2012.

- Help desk Unity
    - 14 September 2012.

**Manufacturers:**

- Bart Laureys (Product developer refrigeration systems, , Belgium)
    - 14 August 2012.

- Inge Plochaert (Country Manager, UK AB INBEV, Luton, United Kingdom)
    - 14 September 2012.

### 1.5.2 Gantt Chart

Everything done in the project was scheduled. In the Gantt chart can be find back how much time was spend on each topic. A lot of time was lost with the search after information how the Unity game engine could be used for making a working solution.

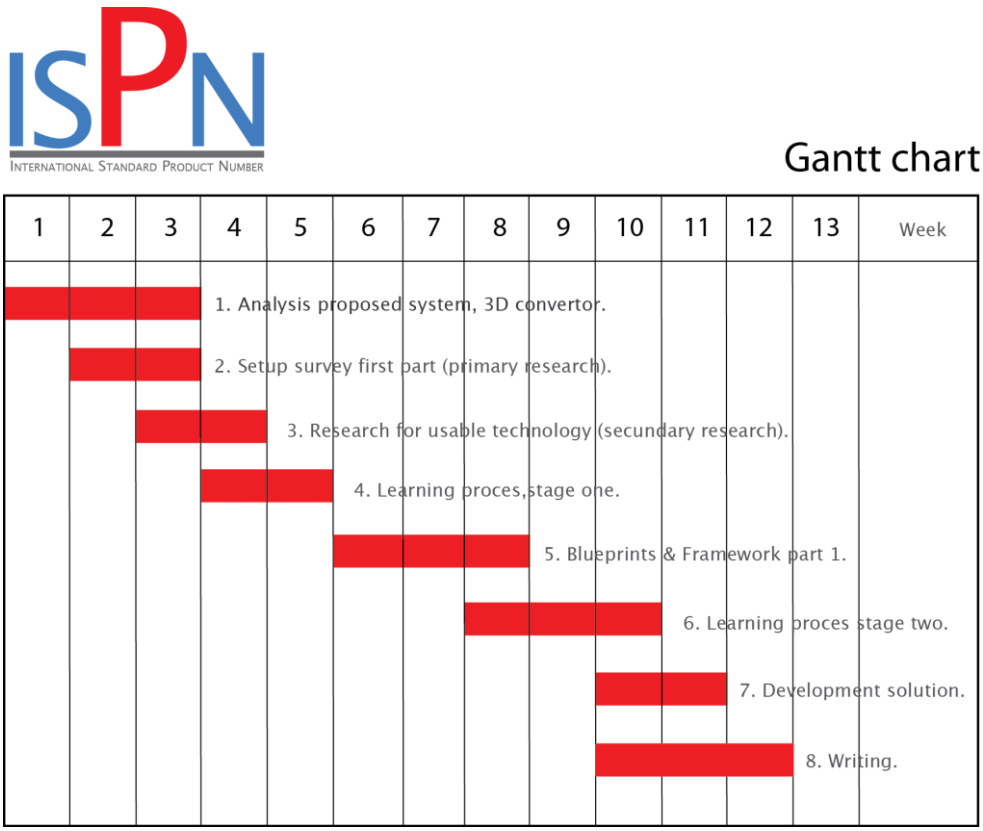



Figure 2: Gantt chart of the scheduled performed tasks.

# CHAPTER II

# SURVEYS

## 1.62.1 About the survey

### 1.6.1 Workflow survey

Survey workflow for ISPN-system

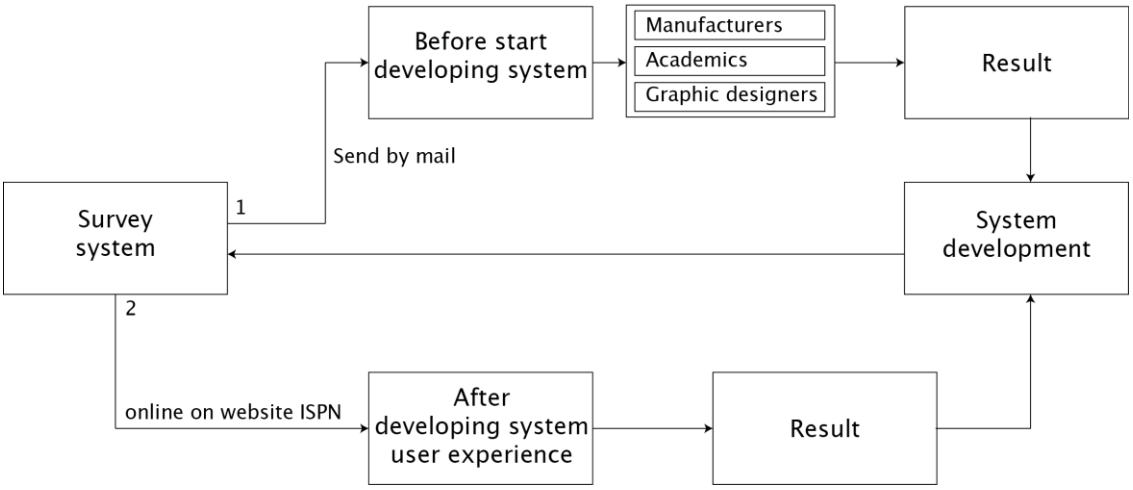



Figure 3: presentation of how surveys were conducted.

The conducted survey consisted of 2 parts. One part was done before the start of the project itself (some were conducted later. Due the holidays a lot of people were not available at the start of the project), the second part was an online survey after the proposed solution was running online. For the first part adjustable PDF documents were made containing an explanation of the proposed system and Multiple Choice questions. For some additional information could be added in text fields. There was no use of any exiting online survey system. The surveys were self-developed using Adobe Live Cycle designer a tool for making surveys on a PDF base. For the second part a customized LimeSurvey solution was chosen. This was installed on the server where the website was hosted and made part of the website.

### 1.6.2 Concept of survey

From start the goal of the survey was to involve the contacted people. These people needed sufficient knowledge about the subject. One group was contacted in person to participate in an interview, other groups were contacted personally to participate in a survey. Only questionnaires from these contacted people were used in the survey. This all to avoid the influence of non-professional people in the survey. A project like this, when it will go further on, needs a solid survey base before starting a costly development. It can't be based on an internet survey where thousands of people take their subjective, non-professional opinion for true. After all, this took more time than sending mails around the world and a good selection of candidates had to be made. On the other hand there was a direct contact with the target group and people who could be involved to help developing the ISPN-system. Three different kinds of groups were withhold:

- Group 1: large manufacturers, making products which are sold in supermarkets.
- Group 2: IT professionals, academics working on the same matter or related to.
- Group 3: professional end users from graphic companies and website developers.

To manufacturers and academics the blueprint of the system was presented. Appended questions were added for both groups but different for each. For the manufacturers representation multinational companies were contacted. It was assumed they could benefit the most of an ISPN-system and 3D representation. If the project could go on a global meeting could be held to start up a workgroup to back up the development of the system. Question at the meeting would be if the interviewee are interested in participating meetings to set up the system. For each part of the system a workgroup could be setup. These workgroups could attract extra developers when money from the manufacturers becomes available for further development of the system.

### 1.6.3 Standard questions for manufacturers are:

- Are products often presented in an inferior quality in magazines or newspapers?
- Is an 3D presentation of a product an added (commercial) value on a company website, web shop, brochure or flyers?
- Do you sell products in different countries with different marketing strategies?
- Can a system like ISPN be useful to distribute decent footage of your products?
- If a simple 3D tool is available to render an 3D representation of your own products,
- could a staff member of your company be involved to use this system?
- Is your company willing to assist developing the ISPN further in the future?
- Is your company prepared to pay an annual contribution to maintain and develop the ISPN system and 3D convertor?
- Do you have points of criticisms about the proposed ISPN-system or 3D solution?
- What manufactures your company?

### 1.6.4 Standard questions for the IT professionals are:

- Are the objectives of the Msc part well presented?
- Are these (Msc project) achievable in the available time (8 weeks)?
- Have you experience with a related topics and are there points where can be run in trouble or encounter problems?
- Can you give extra references or advice to avoid these problems.
- Would it be useful to you to work out the complete system in a PhD?
- Do you find the setup of the ISPN-system healthy?
- Do you have recommendations or ideas of your own to add?

### 1.6.5 Standard questions for the graphic professionals and web developers are:

- Do you have often problems with getting good footage?
- When you ask for footage material does it take a long time to get?
- In general do you think a system like ISPN would be useful to you?
- Do you use often 3D footage in your work for the moment?
- Are your clients aware of the added value of presenting products in 3D?
- Do you think 3D content will be wider used in commercial media next years?
- Do you have some critical notes about the setup of the proposed ISPN system?
-

## 2.2 Conducted surveys and results

### 2.2.1 Survey manufacturer

#### 2.2.1.1 Interview manufacturers

Interview Inge Plochaet.
BU President UK & Ireland Inbev.
www.ab-inbev.com
Interview date: 07/09/2012.

*Alain:*
Does your company sometimes notice bad material in publicities.

*Inge:*
Yes that happens sometimes. But we work with a system of retailers. They are mainly responsible about the material they use for publicity goals. Only national campaigns are under our control. But I have my doubts the ISPN-system could resolve this problem.

*Alain:*
Could you see the ISPN system as a way to get information quicker to the end user/reseller?

*Inge:*
Perhaps yes, it would be good to pass information more directly to the reseller but this could also be done by an internal system of our own. We already have a database system where most of the pictures can be found back.

*Alain:*
In fact the goal of the system is to put a broad range of information available to graphic designers and website developers not only still images but also product information which could be used for example to calculate the amount of nutritive value.

*Inge:*
For such purposes , yes it could have some sense.

*Alain:*
Do you think 3D is an added value for sales.

*Inge:*
Yes it could but it's difficult to have 3D footage from all our products especially animation.

*Alain:*
Yes that why we thought to combine the ISPN-system with a 3D convertor for still images and animations.

*Inge:*
Yes that's a great idea but you still need footage to make the 3D. And that isn't always there. And how to make 3D from such a big amount of different products?

*Alain:*
research has been done to do it with a camera system. But this delivers files that are to big in size, too much vertices and a low fps. Our system would let you specific choices for example bottles, boxes, etc...

*Inge:*
I think it will be a long list of objects that could be sold in the supermarket…

*Alain:*
yes I know the system is there still not waterproof. Do you think your company wants to get involved in the development of the system and want to make a contribution?

*Inge:*
I don't know. Such a system is only livable when it's supported by a lot of companies.

*Alain:*
ok, thanks for the comments.

Interview Bart Laureys.
Product developer.
www.aximaref-gdfsuez.be
Interview date: 01/08/2012.

*Alain:*
Does your company sometimes notice bad material in publicities.

*Bart:*
Not that I aware of. Not that many companies sell our products. We don't sell in supermarkets, it's more business to business.
*Alain:*
Could you see the ISPN system as a way to get information quicker to the end user/reseller?

*Bart:*
Because we're not selling to individuals but other companies new product information is relative fast at the resellers/installers. How it's presented further to their costumers we don't follow up.

*Alain:*
Don't you think there is a place for a system like the ISPN-system in your organization?

*Bart:*
Yes it could be useful but our printers or website developers get their material from us directly. Which is descend material from first hand. That's something else then when there is chain of selling from manufacturer to reseller, wholesale, retail and shops. For those people the ISPN-system could be more interesting.

*Alain:*
All right, what do you think of adding 3D to printing and website?

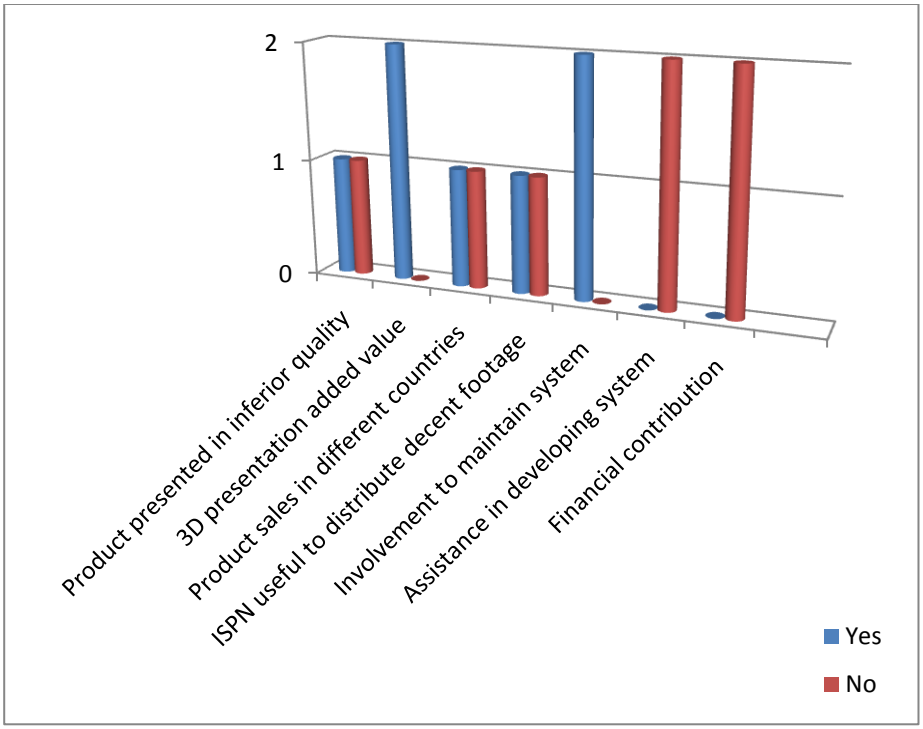
*Bart:*
For sure it will be a great feature. It's always nice to see products in a most realistic way. Specially for technical devices were in most cases already a CAD design exists. Must not be too hard to get a nice shiny 3D of it.

*Alain:*
I will see that… Does your company wants to get involved in the development of the ISPN-system?

*Bart:*
No, I don't think so.

*Alain:*
Ok, thanks for the comments.

#### 2.1.1.2 Results questionnaire manufacturers.




Graph 1: graph results questionnaire manufacturers.

Only two representatives wanted to participate for this survey. Perhaps the requested interview was too much for them. Managers of sales departments are busy scheduled. The two participants were Bart Laureys from Axima (GDF Suez) and Inge plochaet from ABInBev. The first company is a manufacturer of refrigeration systems (device manufacturer) and the second is a well-known beer brewer (Jupiler, Stella Artois, Budweiser, Hoegaarden, etc...). Both persons were interviewed at their locations. The statistical value of this survey was of course very small, with only two participants, but nevertheless it showed a different look at the added value of descent footage material. Although hardware could also sell more when put in an attractive Belga. Bart Laureys wasn't aware of bad footage material or that it should be important for better representation of their products. For sure both interviewees didn't want to give assistance in developing the ISPN system or do some financial contribution. When the system is there they will take a look at it and use or ignore it. Anyway the financial contribution will be a huge obstacle to take and at this point a lot of extra investigation needs to be done. Without necessary financial support of manufacturers it will be very hard to retain the ISPN-system. 3D representation at prints or websites was seen as an added value. Inge Plochaet from InBev stated that it will be a huge task to provide all possible forms of 3D with the presented solutions. Question arose if it isn't better to work with a camera system and taking pictures of the object and rebuild a 3D object this way.

#### 2.1.1.3 Conclusion questionnaire manufactures.

- **For the ISPN-system.**
  - No financial support or developing support.
  - Make the system first, we will see it can be useful and works.
  - When system all right they get involved.
- **For 3D representation and 3D animation in commercial website.**
  - It's an added value.
  - Doubts about what will be best technique to represent 3D.

### 2.2.2 Survey academics

#### 2.2.2.1 Comments of academics

"The idea of the ISPN-system is healthy but it inherently needs the implementation of a firm control system. Convincing companies to pay a fee for the services could pose some initial skepticism. A workaround to persuade potential customers could be the use of intelligent demos showing the advantages towards online applications. What about (international) legal implications? ISPN usage could be restricted to certain applications for registered partners only, no usage "in the wild" without control from the original product manufacturers on the end user..."

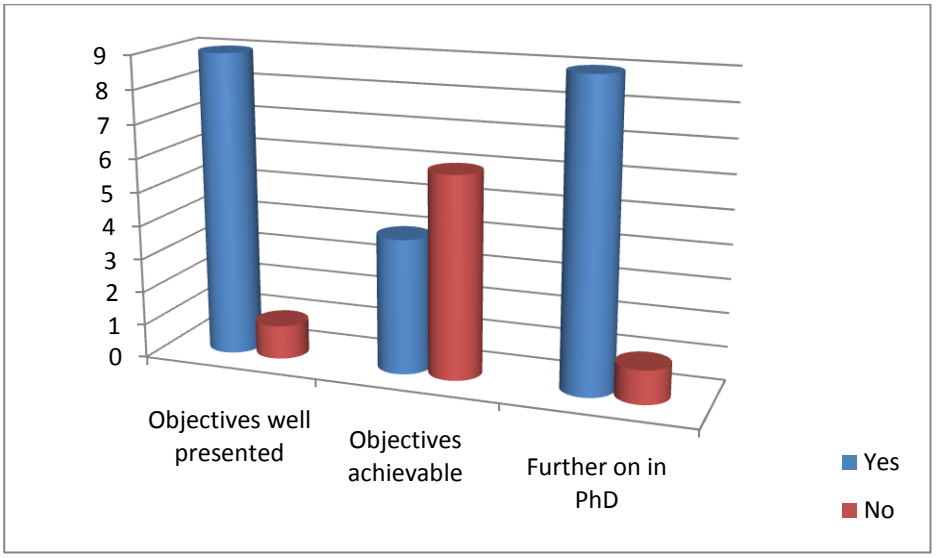
"By including the barcodes of the products into the database, the system can be used for more applications. Each product has its own barcode. The reading process of the images can thus also be automated. Supermarkets are already working with barcodes for their products through the whole system. Besides advertising purposes, including visualization of the cash register can be possible. Even with self-scanning systems can, during scanning of the product, 3D visualization made visible as an indication that the product has scanned in. Perhaps first examine or in this situation the use of an object-oriented database can be more suitable instead of a relational database?"

"I think 3D on internet is an item that never broke through on a big scale. I think more research would be needed on how to lower the barriers for a large scope audience. Also more research is needed on how to make search and navigating a large database of 3D objectives efficient and intuitive."

"Many kind of objects available in a supermarket. It's great to try 3D more "common" but to generate online the diversity of products will be a problem."

#### 2.2.2.2 Results questionnaire academics.

Ten people of the academics group did respond they want to participate in a survey. Some of them added some comments which can be found back in previous paragraph. Below the result in a graph.




Graph 2: graph questionnaire academics.

It seems the objectives are well presented. About the fact that the objectives were achievable in the available time, there is some doubt. 60% of the participants think there will be a lot more time needed to achieve the objectives. 90% of the respondents find the subject interesting enough to go ahead with the ISPN-system in a PhD.

#### 2.2.2.3 Conclusion questionnaire academics

- Objectives are well presented.
- Objectives possible not achievable in available time.
- Finish project in PhD.

### 2.2.3 Survey graphic designers and website developers

#### 2.2.3.1 Comments of graphic designers and website developers

“Will be a big job.”

“At the moment we would like to use more 3D footage content but because of lack of footage, we do not use it. So I think this ISPN system could be a solution.”

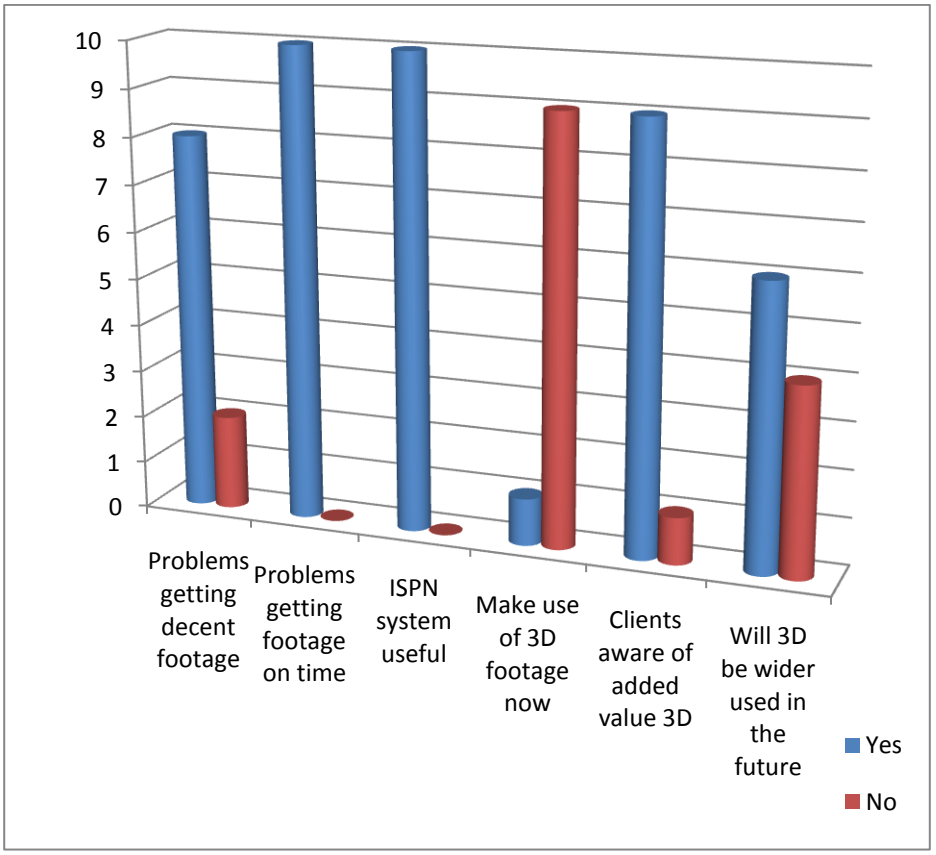
“Waiting for years.”

"Looks good"

"As a publicity agency we are in direct contact with retail and manufacturers who works with professional photographers. Shooting footage is often a part of the job."

#### 2.2.3.2 Results questionnaire graphic designers and web developers

At the bottom end of the information flow there's obviously a problem. It's clear needed information isn't getting there where it has to be. 80% of respondents says they have a problem with getting decent footage material to work with. Even 100% stated they don't get material in time and are having problems meeting deadlines. It's no surprise that this group wants a system like ISPN.




Graph 3: graph questionnaire graphic designers and web developers.

This group also wants 3D footage to use. Their clients are aware of the added value of 3D representation but they just don't get the right footage for it. 90% doesn't use get 3D footage but also 90% of their clients are aware of the fact 3D is an added value to sell more products.

#### 2.2.3.3 Conclusion questionnaire graphic designers and web developers

- **For the ISPN-system.**
  - Big need of descent footage and preferably quicker available.
  - ISPN-system should be very useful.
- **For 3D representation and 3D animation ²in commercial website.**
  - Clients want it as an extra sales gimmick.
  - 3D content urgent wanted.
  - Will be wider accepted in future.

### 2.2.4 Online user survey ISPN-system

The second part consisted of an online survey. This survey was situated on the ISPN website itself and not on a third party website. Also no online tool like survey monkey was involved. To reach this goal a solution which could be installed on a webserver needed to be found. A free and decent solution was found called Limesurvey (http://www.limesurvey.org/), which code could be downloaded from their website and uploaded to the ISPN website. A separated database was generated on the webserver to hold data from the surveys. Goal from this survey was to get information from users who already used the 3D convertor tool. This information could be used to improve the usability of the tool in the future.

The questions were:

- Did you need to update your browser or use another one to use the 3D convertor?
- Is the interface of the convertor clear and easy to work with?
- Is the quality of the previews acceptable?
- Are the proposed measurements enough?
- Do you have problems with viewing the pop-ups (enlargements)?
- Did you have any crash until now?
- Did you face major problems? Can you describe them shortly.

The survey was being kept short and to the point. Long surveys doesn't encourage many people to participate. Link to the survey is http://www.ispn-system.org /limesurvey/index.php?sid=17647&lang=en

There's also a token active to keep intruders outside. This token is user and is set to 100 entries. The survey system has also an admin part where statistic of the surveys can be viewed or exported:

http://www.ispn-system.org/limesurvey/admin/.

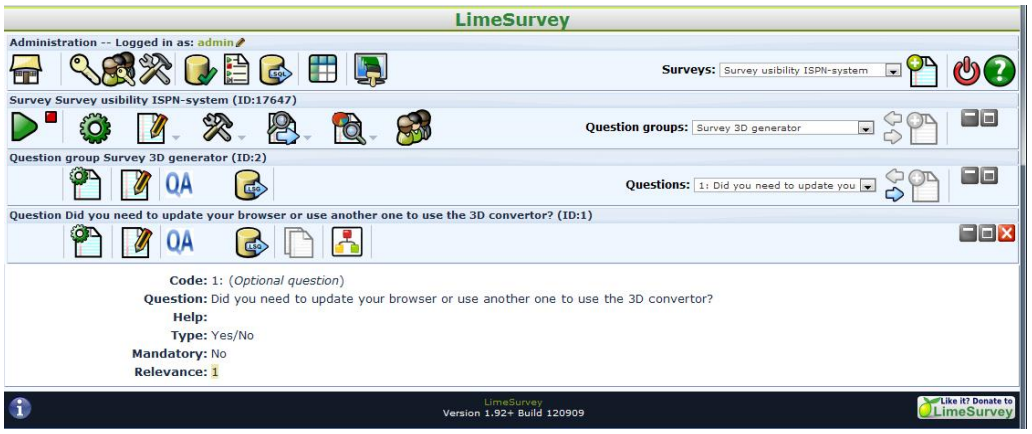



Figure 4: admin part of the online users survey.

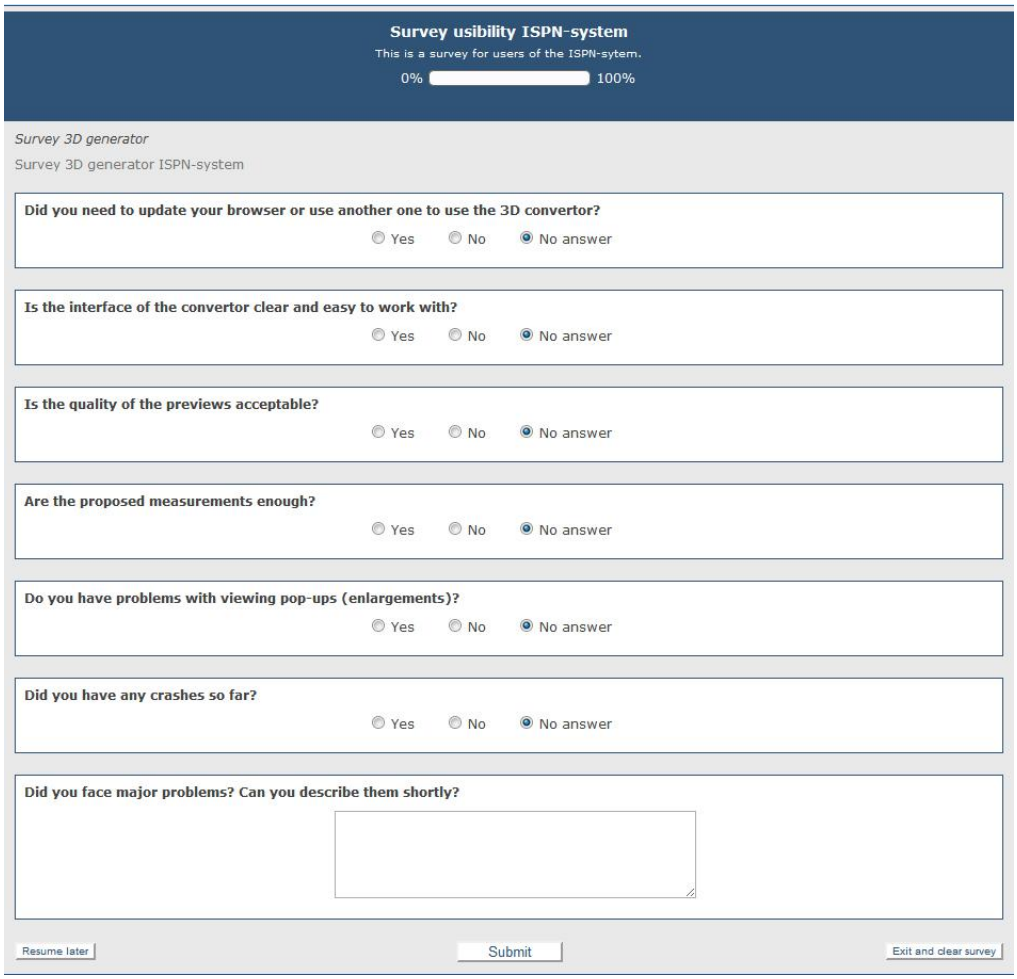



Figure 5: form user survey.

## 2.3 Conclusion surveys

After this survey it was clear it was a go for working out the system. From the viewpoint of graphic designers and website developers there's a demand for a system presenting a decent solution to deploy 3D still images and 3D animations for the web. A solution that can be seen as the successor of Flash as an animation tool for the web.

Large manufacturers are not interested in participating developing the ISPN-system. Also any kind of investment is a nod for the moment. This because there's already an expensive solution they use and on the other hand they got their own internal system. So the initial goal of getting large manufacturers wasn't perhaps a good idea. Perhaps smaller manufacturers could be a better target group in this case.

To illustrate the vision of the large manufacturers some inside information from InBev.

"There is an external database called Brandbank where AB InBev, along with our competitors, upload 3D/2D pack images for retailers to download for their use. AB InBev pay an annual fee for this service and I believe there is an approx £80 charge for every image uploaded to this database. The approximate renewal fee is around £13000 with additional images/new skus (£82 each) throughout the year bringing the overall cost to around £15000 + vat. Brandbank is used by Asda, Sainsbury, Tesco, Co-op, Waitrose and wholesalers such as Nisa, Booker, Bestways, Musgrave's. I can obtain a full list is you wish. Brandbank have a direct relationship with the retailers and images are fed direct to the retailers websites. Brandbank therefore assists both sides with ensuring the correct images are on always on feed so there are no missing images or incorrect data. The retailers refer any queries regarding images related to their website directly to Brandbank. In addition many agencies working for the retailers are then referred to Brandbank to download images for marketing etc.

AB InBev also have their own internal asset management system where agencies, printers, internal colleagues can upload/download all AB InBev digital assets i.e. 3D images, 2D images, POCM,PDF artwork etc. This global database was launched at the start of 2012 by Jef Vandercruys and is called the DAM system, link as follows:**http://dam.ab-inbev.com/login_internal.jsf**"

# CHAPTER III

# LITERATURE REVIEW

## 3.1 Short case study shortlisted available technology

### 3.1.1 Case study used webserver

Most popular webserver (HTTP server) for the moment is Apache. According to a survey of w3techs.com[1] Apache is used by almost 65% of all websites. It's free open source software and provide a full range of web server features. The possibilities are far more than we need for our project. Everything about the Apache project can be found back at www.apache.org.

### 3.1.2 Case study database system.

Apache is often associated with PHP and MySQL. PHP is a script language with which object-oriented and function oriented programming is possible. Other script languages are Perl, Python en Ruby. According to the same source as the Apache market share, PHP is used by 78% of all websites. If the ISPN website should get higher traffic Perl or Python could be used as alternative. As database technology could be started with MySQL. This is the most popular open source database system today. If necessary when database get a heavy load SQL or Oracle could be used instead. In the appendix section, links to the different mentioned technologies are available. Information about PHP can be found at www.php.net and www.mysql.com.

### 3.1.3 Case study 3D technology for web.

#### 3.1.3.1 WebGL

WebGL is an API that connects JavaScript with OpenGL ES 2.0. OpenGL ES 2.0 is based on the desktop OpenGL. Main difference is that redundant functionality and features not suitable for embedded devices were removed from the code. It can be seen as a "light" version of OpenGL. Main difference with other solutions for 3D on the web, this is not using a plugin to view 3D content but is part of the webpage itself. Open GL ES is maintained by the Khronos group which is a collaboration between GPU and browser vendors. One browser vendor is not a member of the Khronos group, namely Microsoft. This also the reason why Internet Explorer is not supporting WebGL. WebGL is a low level Javascript binding to OpenGL ES 2.0 (direct access to OpenGL ES 2.0). This in contrast with the Google solution O3D, which is a higher level scene graph. WebGL also relays on the HTML5 canvas. This is a rectangular area on a webpage were graphics can be drawn using JavaScript.

**Stages**

[1] http://w3techs.com/technologies/overview/web_server/all

Different stages can be found back in the WebGL pipeline. Two most important and programmable stages are Vertex shader and Fragment shader. After the data has gone through the complete pipeline the result is kept in what is called the drawing buffer. A drawing buffer is the same as frame buffer in OpenGL. The Khronos group website: www.khronos.org.

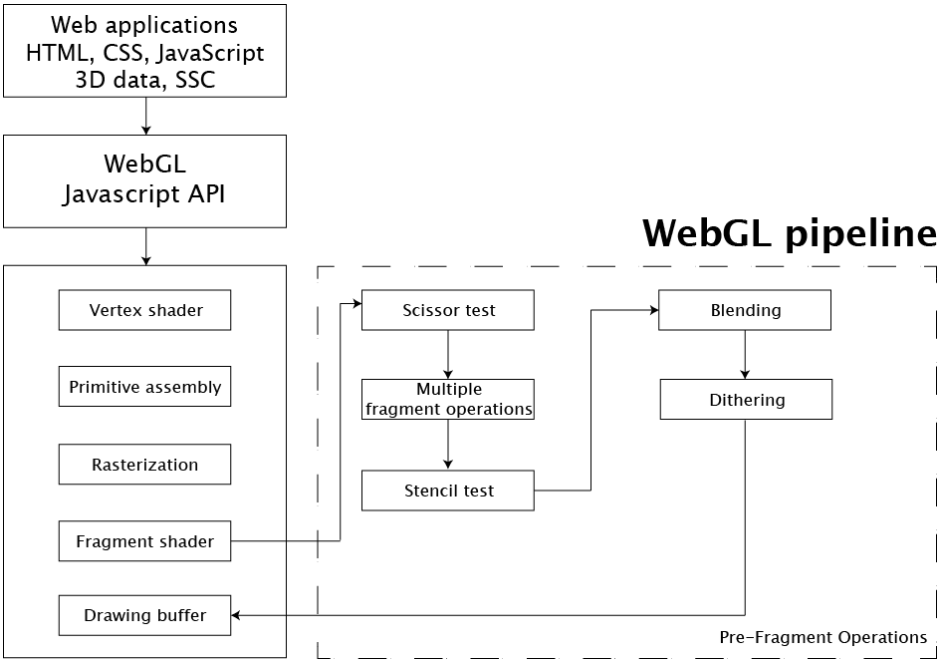



Figure 4: The WebGL pipeline explained to display 3D content on webpage.

### 3.1.3.2 Unity

Unity is a 3D game engine. Unity is involved because it has also the capabilities to represent 3D image, still and animated, on the web. This is thanks the Web Player which can be found at File --- Build & Run. The idea was to use Unity web player like flash uses .swf. One big file where everything is included, no external docs needed to work etc… A lot of contact was held with Unity3D to gain information about the fact it could be done. Accept the answer "it could be possible" no extra information was provided. The idea was to use input fields for dimensions and pictures to be incorporated in the Unity solution en not outside the solution. Perhaps this could be a subject for a project on his own.

### 3.1.3.3 X3D

The third technology where research is done after to present 3D content on the web is X3D[2]. X3D is an open standard file format that is royalty-free. X3d is a system that can storage, collect and playback real time graphic content

[2] www.web3D.org/x3d

which is embedded in (web) applications. It's also an ISO ratified standard. X3D is a plugin based solution but has also a lot of advantages.

**A few advantages of X3D**

- Scalable and open software standard.
- Interactive 3D content.
- Cross platform and can be used in a broad range of applications.
- Both web and non-web applications can incorporate real-time 3D data.
- Modular structure.
- Open source. Incorporated into the MPEG-4 multimedia standard.
- Compatible with next generation of graphic files (SVG).
- 3D objects can be manipulated in C++ or Java.

**What about X3D technology**

X3D is node based. The scene graph can be seen as a tree with a defined beginning and for each node there are parent-child relationships. No loops are involved in the system. X3D is built on VRML (Virtual Reality Modelling Language). VRML is a text file in which vertices can be saved. Also colours, textures, transparency can be saved into the file. For viewing X3d content the VRML browser plugin needs to be installed. Installing this allows to view 3D objects from all sides, rotate and scale them. To encode both .xml and .vrml based file formats can be used. The developers of X3D took out all functionality and make it language neutral. How it does look, what does it do, how does it works is written down in the functional abstract specification which can be found in the middle of the next graph. Any coding technique around can be used to create things. The middle part says how it has to be done.

**X3D browsers**

As stated before X3d makes use of a plugin to add the possibility to web browsers, like Internet Explorer and Firefox, to show 3D content. An advantage of this plugin is that all information to display 3D data on a consistent way is inside the plugin. So developers can concentrate themselves on the creation of X3D models instead of trying to write difficult code to get everything working. Below a scheme how information is handled by the plugin. In fact the plugin is doing all the work to present 3D content in a decent way. This also means that good content remains valid even when web browsers get updated. The needed plugin can be downloaded from http://www.web3d.org/realtime-3d/x3d/getting-started at the www.web3D.org website. This plug-in is called BS Contact and is about 7,5 MB to download. This plugin is not for free but others are too old or doesn't work

with Google Chrome. There's also a HTML5 alternative to incorporate X3D code into a HTML page This has a smaller feature-set than the BS Contact. For this a WebGL compatible browser is needed.

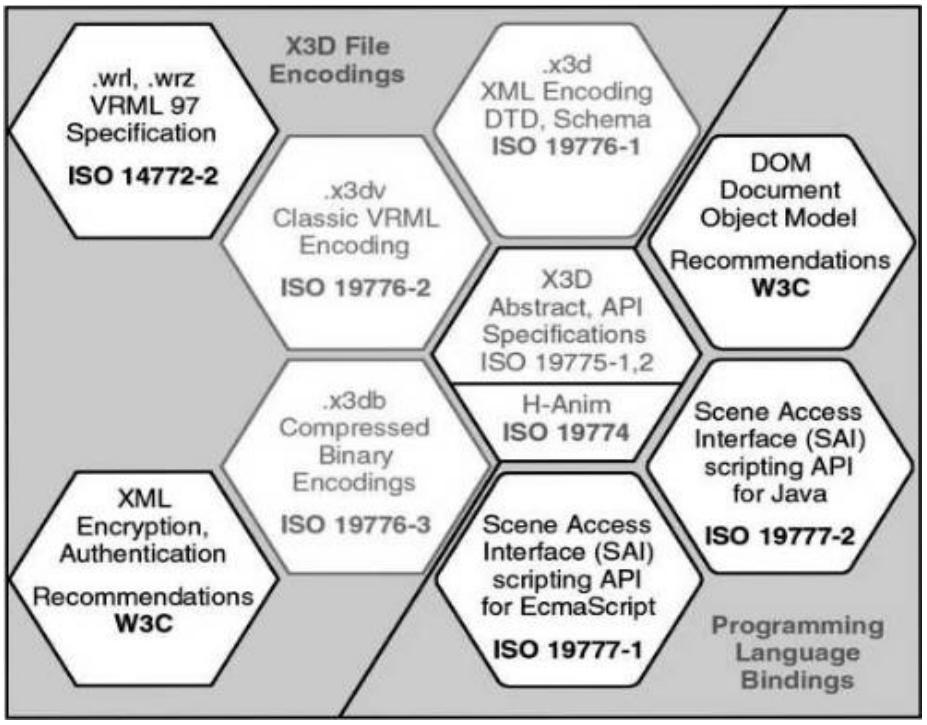



Figure 6: one API that can handle all different sources (image: web3D.org)

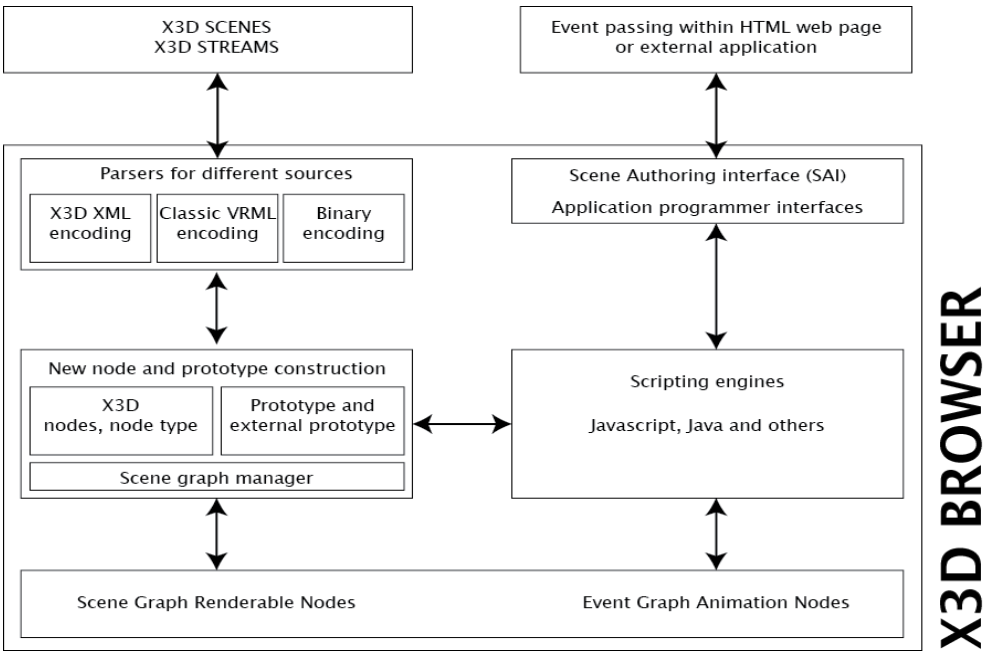



Figure 7: Scheme X3D browser to view 3D content on a webpage.

### X3D specifications

Everything about the X3D specifications can be found back very detailed on the web3D.org website[3]. Documents that can be found on the website defines the geometry and behaviour possibilities of classic VRML in conjunction of using Web-compatible tag sets of XML. This is the magic word for X3D. XML has customized tags for structuring data and is easily to understand by both humans and computer systems. It's also license free, platform independent and well documented. To compare with X3d terminology scene, graphs, nodes and field correspond with documents, elements and attributes. What so nice about X3d is that the primary functionality of nodes and fields are specified in a technology-neutral way. There's no binding with any particular file encoding or programming-language. The X3D Abstract Specification[2] is the reference to be followed on how a X3D scene graph works. With doing this the X3D Working Group ensure that each file-format encoding and language binding stays compatible, interoperable and functionally identical with others. DOM (Document Object Model) is also a language neutral API that can processing XML documents. But DOM uses string-based accessory methods to set values of attributes and elements. Because of this string-based property it's too slow to use for real time interactive 3D graphics.

**Advantages scene graphs relative to Direct X and OpenGL**

Most important advantage compared with OpenGL and Direct X is that it's easier to learn because it rely a lot more on modular behaviour than programming coding. So you don't need to be a great programmer to set up a scene graph. Another advantage is that a scene graph can also make use of ray tracing. Ray tracing has been incorporated over the last years in hardware so it could speed up and be used for 3D animations. 3D scenes can be more realistic now due the higher performance.

[3] http://www.web3d.org/x3d/specifications/

## 3.2 Case study of existing implementations 3D on the web.

First to say, no setup of a system proposed like this one (ISPN-system) wasn't found or at least not made public. iEEE and ACM doesn't present anything likewise in their libraries. Some parts of the system has some similarities and make use of the same technology but nothing has exactly the same interpretation. For the 3D solution used in the system, different research after technologies for getting 3D to the web were found. These research articles can be found back on the supplied CD.

### 3.2.2 Research implementation based on WebGL.

***Online 3D presentation system for goods***[4]

Another trial to present 3D starting from pictures. With this system pictures of a product are taken under several angles to render a 3D image. This system should have need of low bandwidth but is only good for primitive forms. Problems are that it's sensitive to noise and the back can't be displayed. For the architecture of the system OpenGL is used.

**Towards a Web-based Program Visualization System using Web3D**

Yet to rewrite

### 3.2.3 Research implementation based on Unity3D.

***Extending Web Browsers with a Unity 3D-Based Virtual Worlds Viewer***[5]

This is one of the few research articles that could be found about implementing a 3D engine in a non-game environment. The idea came from IBM who wanted an online live conferencing tool for their employees. The idea came from the Second Life website but the Second Life solution did have some issues that it could be used by IBM. But they were keen to use Second Life implementations… Main reason they couldn't use the Second Life engine was that this solutions needs a heavy download of 47 MB to install and run on the client-sided computers. That was not possible to get worked out on the many low performing computer systems many collaborators had. So they used the Unity 3D engine instead because did need only an plugin install of 1,6 MB. The Unity engine contains everything that's needed to render 3D objects or environments (Texture manager, terrain manager, Object manager, etc…). Of course here is made use of JavaScript to interact with HTML. Field test they held showed that there were fewer technical problems than before with the second life solution. It was no problem to run the meeting on low-profile computer systems. So this seems a solution for the large bandwidth needed by other solutions.

[4] http://ieeexplore.ieee.org/xpl/articleDetails.jsp?tp=&arnumber=6194893&contentType=Conference+Publications&searchField%3DSearch_All%26queryText%3Donline+3D+presentation+system+for+goods

[5] http://ieeexplore.ieee.org/search/searchresult.jsp?newsearch=true&queryText=Extending+Web+Browsers+with+a+Unity+3D-Based+Virtual+Worlds+Viewer&x=29&y=21

### 3.2.4 Research implementation based on X3D.

X3D is used in many try-out solutions. This probably because as stated in the previous chapter it's easy to learn and people with not much program knowledge can start fast with implementing.

***X3D-based Dynamic Interactive 3D Virtual E-shopping Mall***[6]

This article shows that using X3D is a good technology for presenting 3D content on the web but also shows the weakness of it, a massive amount of data needs to be transported over the network what could be a problem with narrow bandwidth networks. This is a proposal of a complete shopping environment which in the background make well use of the node structure of X3D . Our own system must be capable to deliver data that can be implemented in such a system. It's a pity that there's no end result available but used technology seems to XML, JavaScript and of course X3D. At the picture of the framework can be seen that every functionality of the system is split up to reduce workload.

***Dynamic and Interactive Aspects of X3DOM***[7]

Up-to-date article which explain use latest additions made to JavaScript and CCS3 to present 3D content in an web environment. This system make also use of the Document Object Model (DOM). This is a convention which allow representing and interacting with objects in HTML, XHTML and XML documents. This is the most up-to-date solution found for representing 3D content. A look into latest CSS 3D transforms can be useful for our own system.

***PC Virtual Assembly System Based on the VRML/X3D***

This paper shows an example of virtual reality produced with a variety of solutions like X3D/VRML script node but also 3DS Max. The server part is based on ASP technology.

### 3.2.5 General/workflow implementation

These are some articles not related to one specific 3D technology or other then the three technologies mentioned before.

***Making 3D technology universal***[8]

This article is about a file format called U3D specially developed for presenting 3D content from AutoCAD. Research after this file format shows it didn't get wide spread. This is a pity because our system will eventually need to deal with AutoCAD files because a lot of manufacturer make use of this software. This article stated also that X3D will become the

[6] http://ieeexplore.ieee.org/xpl/articleDetails.jsp?tp=&arnumber=5138147&contentType=Conference+Publications&searchField%3DSearch_All%26queryText%3DX3D-based+Dynamic+Interactive+E shopping+Mall

[7] http://0-dl.acm.org.brum.beds.ac.uk/citation.cfm?id=2010425.2010440&coll=DL&dl=ACM&CFID=96971846&CFTOKEN=62487234

[8] http://ieeexplore.ieee.org/xpl/articleDetails.jsp?tp=&arnumber=1492260&contentType=Journals+%26+Magazines&searchField%3DSearch_All%26queryText%3DMAKING+3D+technology+universal

standard for web development. But further investigation about this file format could be useful for our project.

## 3.3 Conclusion

Reading books, journals articles etc… learned that the OpenGL and X3D (or X3DOM) technologies are wide tested and used in different solution to present 3D content on the web. Only the Unity 3D engine is an exception and isn't still much used for 3D solutions on the web, except when it's for a game environment. Problems that many seems to encounter are how to handle with a large amount of data and ways to deliver 3D content for use on the web. For the latter many ways has been tried out do deliver 3D content on a fast way. These systems are often picture based and doesn't seems to work perfect. One solution wasn't able to show the back of a 3D object. A visit to a workshop of 3D-coform at the University of Brighton (visualization of art) learned that the proposed solution of scanning 3D objects and visuals is perhaps interesting for showing on exhibitions but not so useful in a web environment. The tests they did at the workshop generated that much vertices and such a low frame rate (16fps) that this isn't useful for use on the internet. They claimed an extra research of three years was needed to get it proper working…

Most of the articles are using X3D as a solution to present 3D. Obviously many researchers are impressed with the possibilities of XML, X3DOM etc.. But means this it's the best solution to use?

Our solution is going to separate shapes and textures from each other at the input side but at the output side everything is put back together again. A solution to avoid massive data load to a server could be the use of alternative image formats like .png or .svg. Another way is the use of an game engine because a lot of functionalities are already imbedded in this game engine what could speed up things. All the articles can also be found on the CD under chapter III.

# CHAPTER IV

# FRAMEWORK & BLUEPRINTS PROPOSED SYSTEM

## 4.1 Framework and blueprints ISPN system

This chapter is more illustrated then the other ones. Goal is to try a visual impression about the working of a part of the ISPN-system. Let's first show an overview about the work done for the Msc project. As mentioned before the system could be worked out more in another Msc or PhD project.

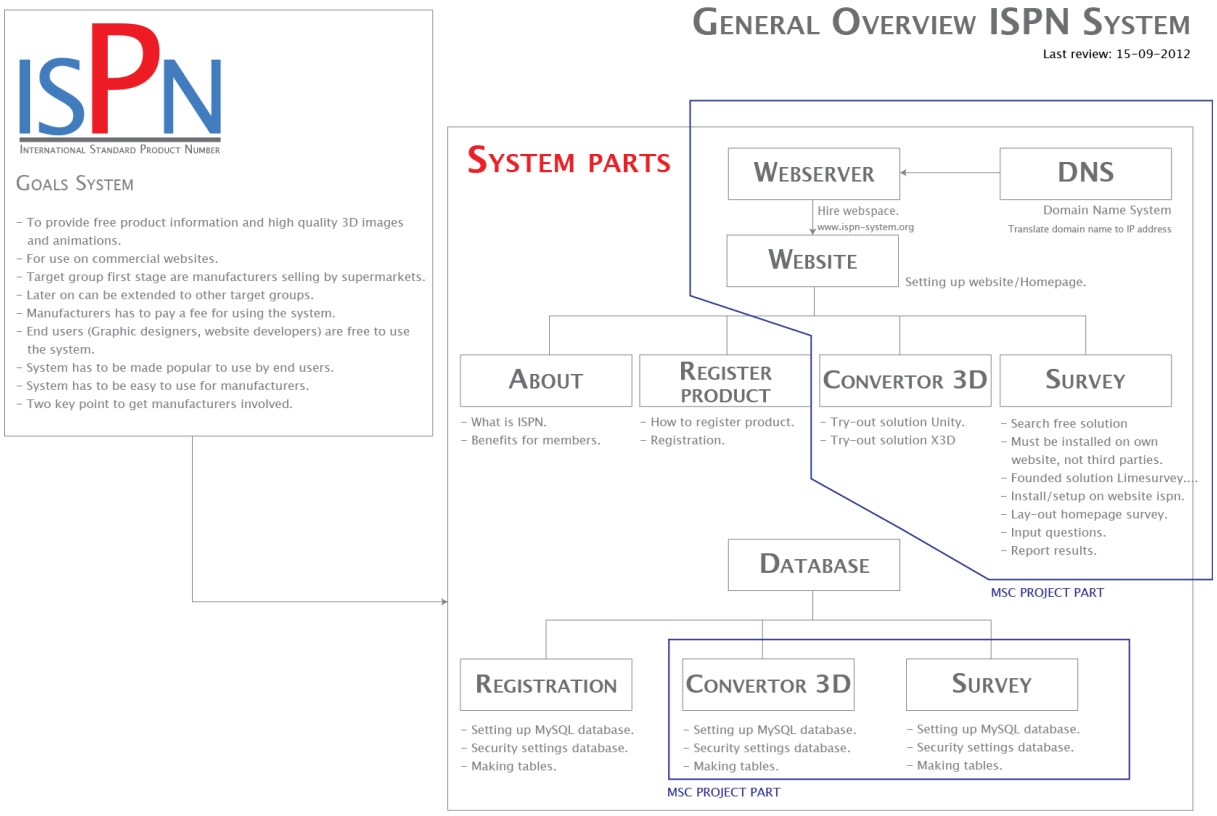



Figure 5: Overview parts done in the Msc project.

### 4.1.1 Framework ISPN system

The name ispn-system.org website was registered at registrar www.register.com and linked to the IP-address of the webserver where the website was hosted. Webserver technologies used are Apache, php and MySQL. An FTP-account was created to upload data to the webserver and 2 MySQL databases were provided. One for the surveys data another one for the 2D and 3D image data.

Before data processed here there's already done some filtering by assigning an ISPN number. First try-out for the ISPN-system was to collect data from products which can be found back at the food department of a warehouse. The package of this food can be done in different ways like carton boxes, bottles, etc… Inside each of these categories a lot of packaging are often the same but just with other labeling. Here could be made a library of different parts of a package which then could be passed through (meta tag) with the ISPN number to 3D generator. This to speed up processing of the 3D objects. In fact the same technology, idea is used like in a SiGGRAPH publication of 2011,

Probabilistic reasoning for assembly-based 3D modeling[9]. Next a scheme representing preprocessing data before sending it to the 3D convertor.

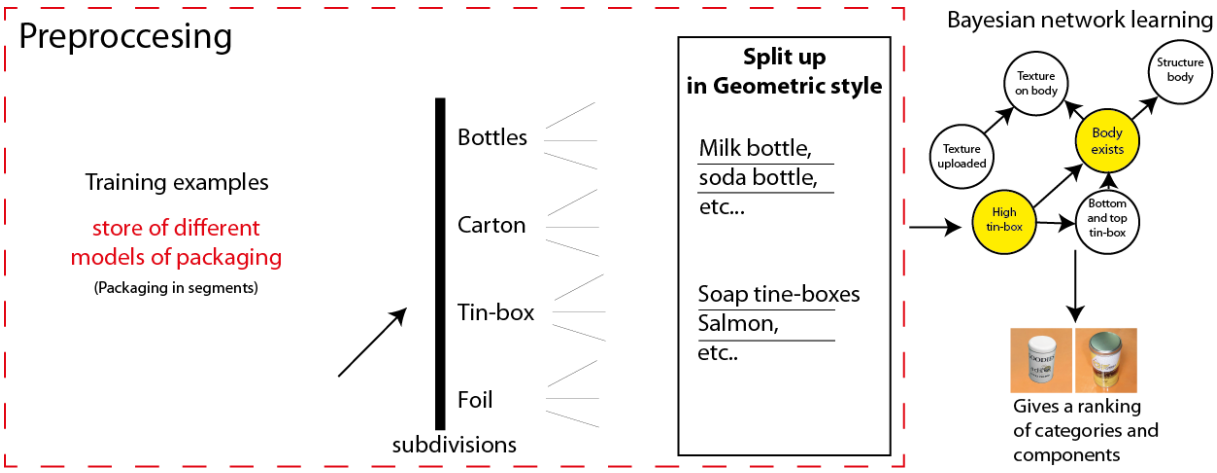



Figure 6: the probabilistic reasoning scheme for the ISPN-system.

The next framework proposal is the convertor part in which the preprocessing is not yet implemented. At the ISPN menu three options are possible, two of them provide the possibility of putting data into the database. Basic is a WebGL or X3D based solution to render 3D images or animations. Extended was planned to be based on a Unity3D solution. However the latter didn't get worked out in time by lack of information to build this solution. Idea was that the Unity 3D solution could deliver a more representative representation of 3D content.

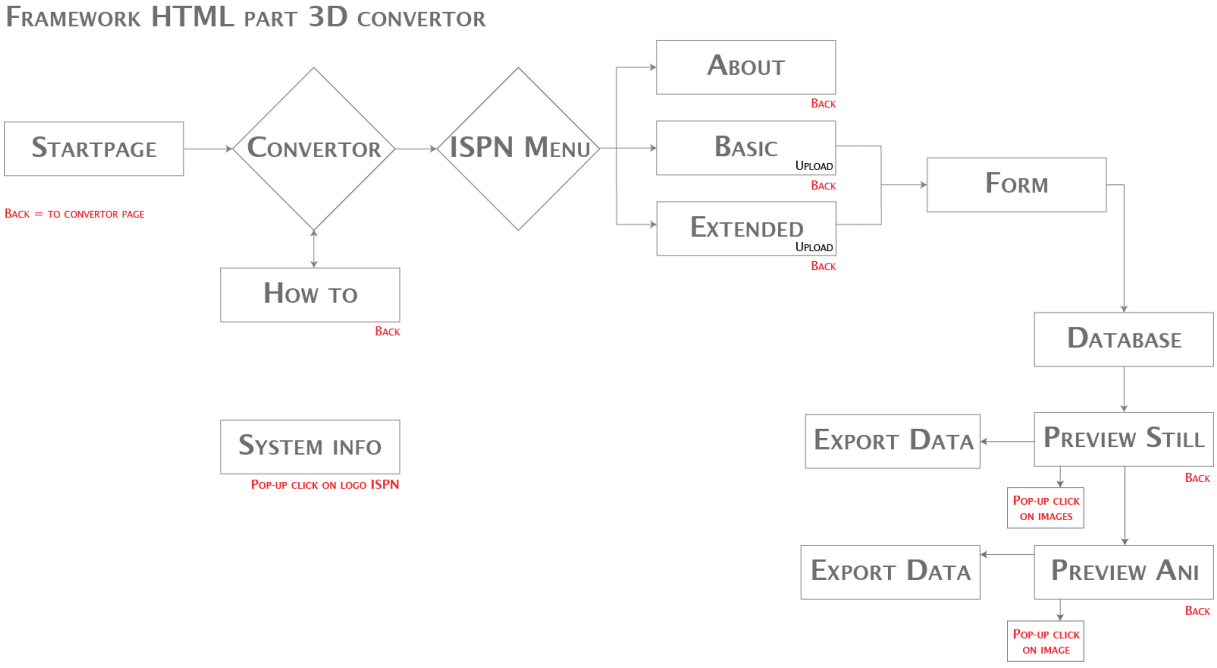



Figure 7: Framework for the 3D convertor.

One of the objectives was that the 3D convertor has to be easy in use. That's why branches are reduced to a minimum.

[9] http://0dl.acm.org.brum.beds.ac.uk/citation.cfm?id=1964921.1964930&coll=DL&dl=ACM&CFID=116678860&CFTOKEN=18312328

### 4.1.2 Blueprint ISPN-system

Each step represented in the framework has been visualized to be used as a guideline for the implementation afterwards.

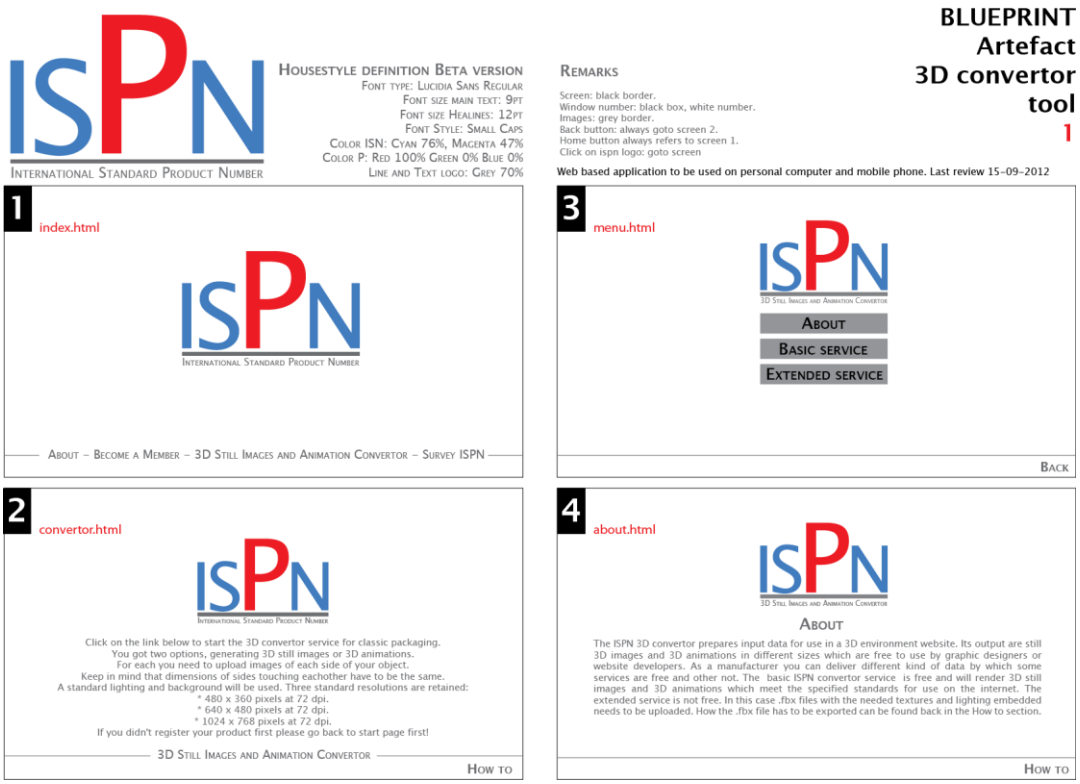



Figure 8: first four screens convertor workflow

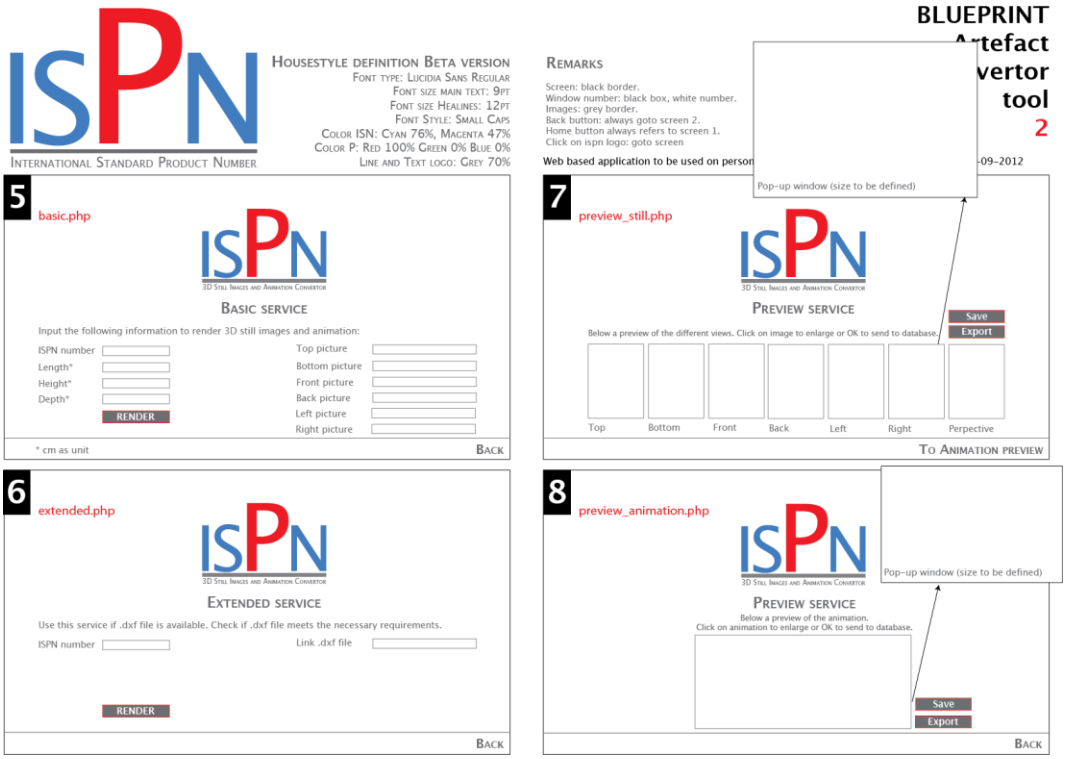



Figure 9: screens 5,7 and 8 has to follow up after eachother for the WebGL solution.

A provisional branding has been created for the ISPN-system. So the system can be presented in a decent way to any interested. Naming of the pages is also displayed on the blueprints. These blueprints can also be used as a manual for users of the system. Blueprint are made in a vector based program so they can easily be enlarged to present the system on a A1 poster.

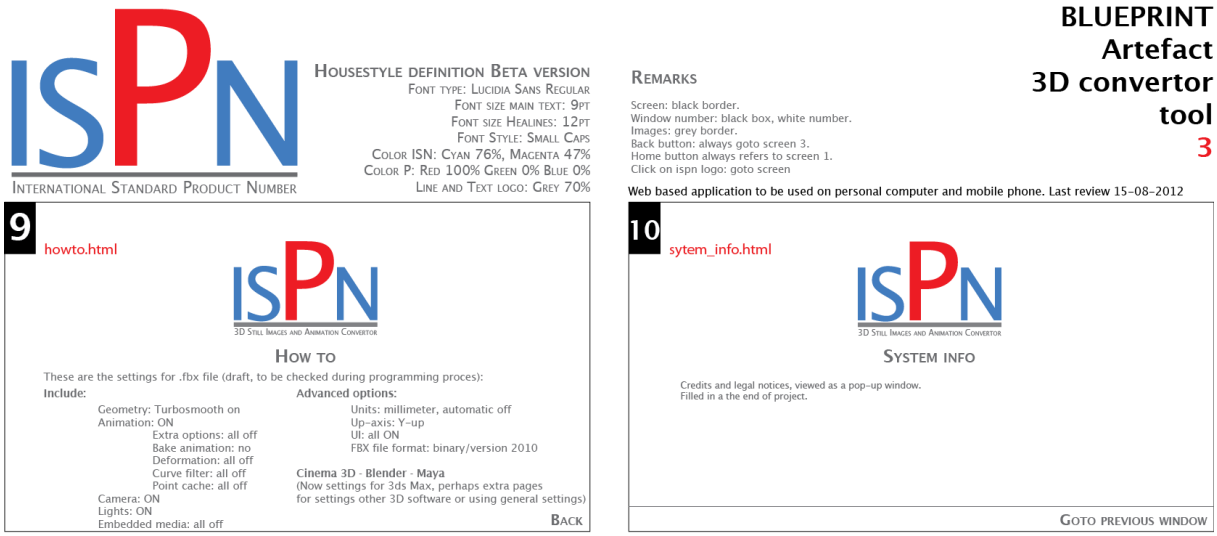



Figure 10: optional screens How To and System info.

### 4.1.2 Framework 3D convertor

This is a detailed view of the framework including the connection between the HTML 5 webpages and the API WebGL. Also a X3D solution could be used to get the same result. Keep in mind when using WebGL it won't work on Internet Explorer. For X3D a plugin will be needed to display 3D content if no conversion to OpenGL has been done.

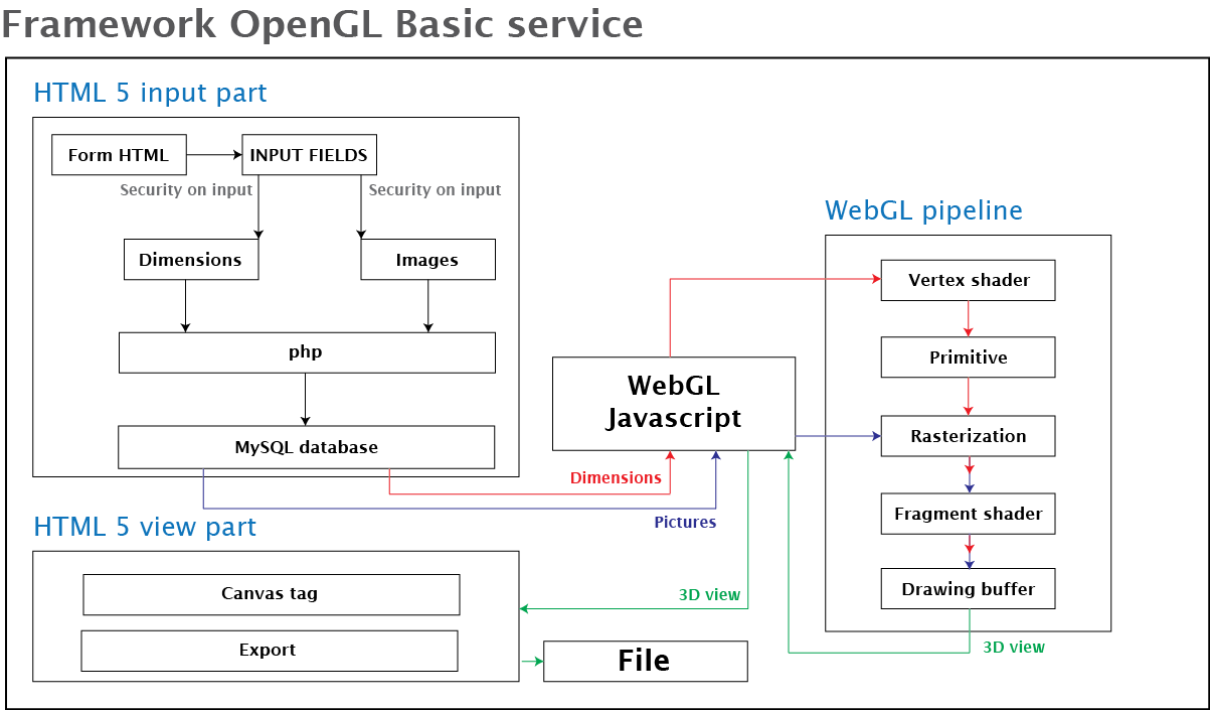



Figure 11:

# CHAPTER V

# IMPLEMENTATION AND TESTING

## 5.1 Implementation and testing database.

### 5.1.1 Implementation database 3D convertor.

For implementation of the HTML and database system a web space on an Apache web server is hired. MySQL has been installed as database system and php as scripting language. Two databases has been setup on the server one for the survey another one for the convertor. To connect to the database phpMyAdmin is used. This is a very user friendly tool to get easy access to the tables and fields of a database.

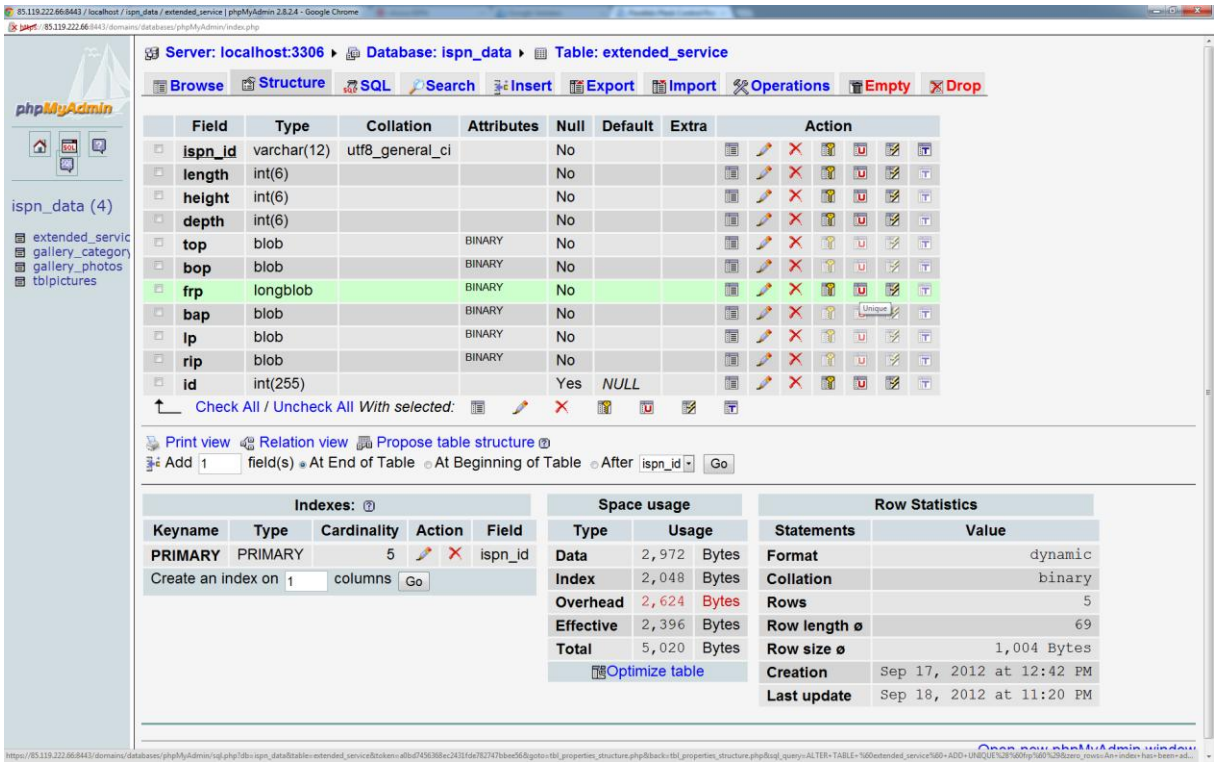



Figure 12: screenshot from the ISPN database.

To store the dimensions of the packaging four fields has been created:

- ispn_id
- length
- Height
- Depth

And to store the 6 pictures, 7 fields has been made, namely id, top (top view), bop (bottom view), frp (front view), bap (back view), lp (left view) and rip (right view). Pictures are scans made from an original package. In first instance was tried out to store the pictures in a field type BLOB. But there were a lot of problems to get the images uploaded. So a second way to do this has been used and seems to work. Now the images are stored in a folder on the server and just links were kept in the database where the original pictures have to be found. BLOB stores the data inside the database and this can make a database heavy when a lot of data is uploaded. Everything in the database has to set to binary or it won't work. With a php script data can be put into the database and taken out again

when needed. The rendered information of the OpenGL is saved in the database and exported to the local computer of the user.

### 5.1.2 Implementation database online survey.

Also for the online survey a database has to be prepared. The database was setup ourselves but the tables are automatically generated by the LimeSurvey solution. A lot of tables are needed here because statistics and other features are involved.

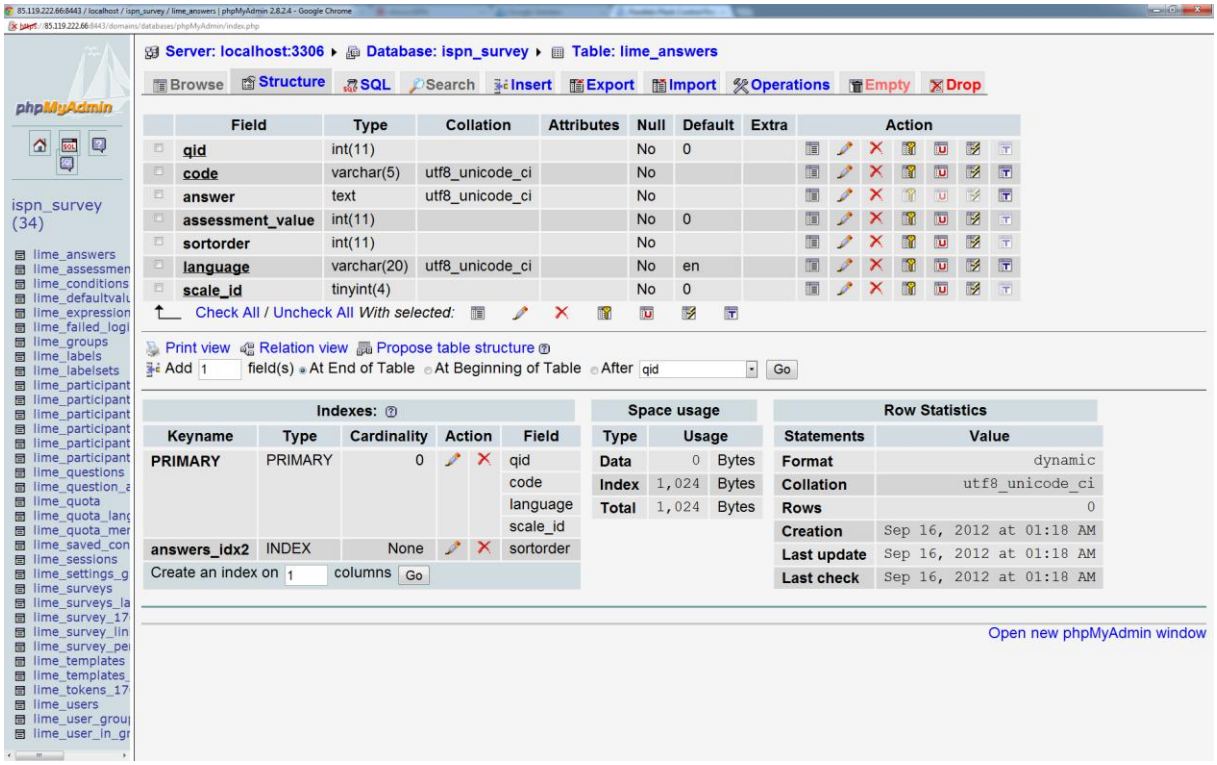



Figure 13: screenshot from the LimeSurvey database.

### 5.1.3 Testing and issues.

Both databases are running on the domain www.ispn-system.org. Data has been entered to test the working of both databases. No problems here to report. There was only one issue and that was with the use of a BLOB field to get images into the database. Therefore the solution of keeping images into a folder on the webserver and put a link to it in the database was chosen.

## 5.2 Implementation and testing HTML/CSS part 3D convertor

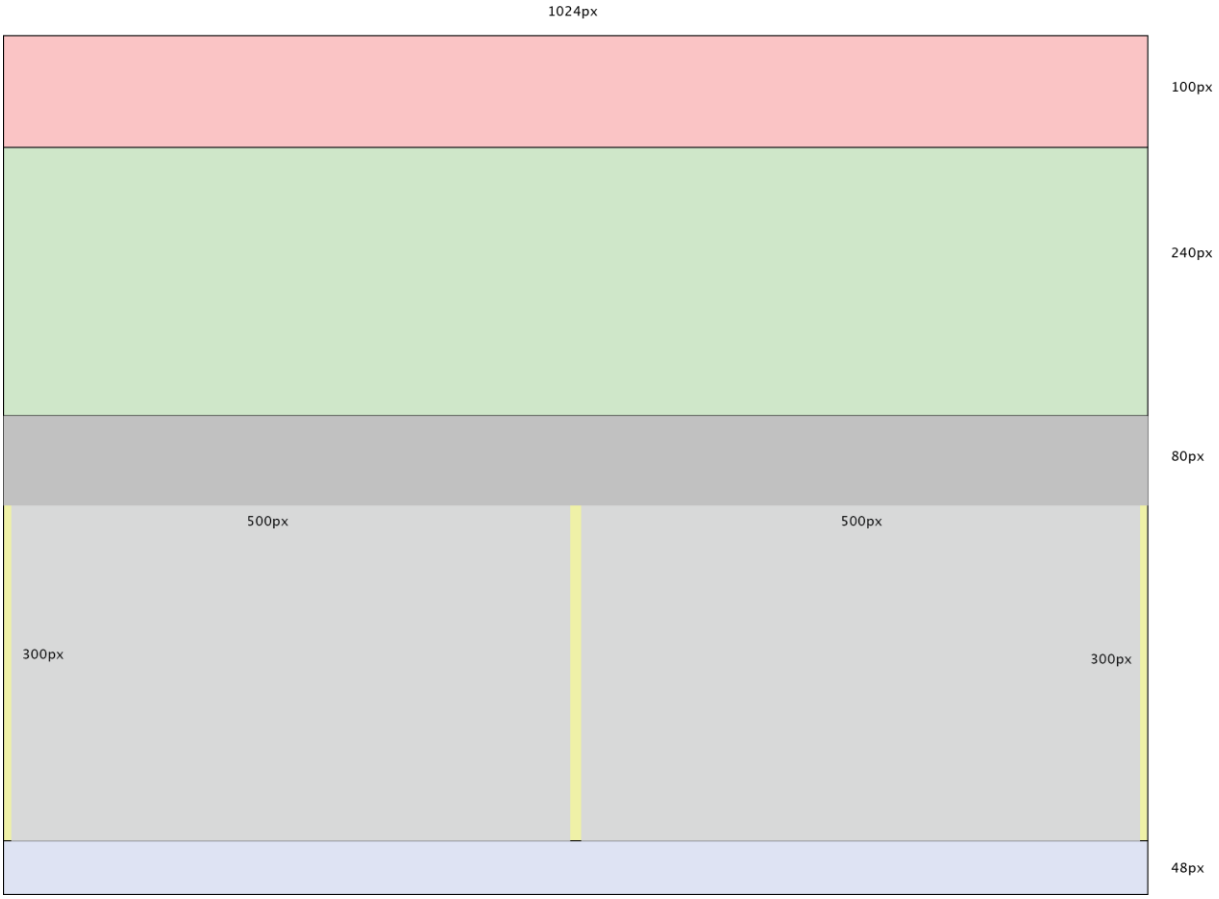
### 5.2.1 HTML setup 3D convertor

To make the necessary webpages HTML 5 and CSS is used to design the webpages. No CSS (and also no php code) can be found back in the visited webpages. All CSS code is situated in separate files. This has the advantages that a CSS style document can be used by multiple webpages (external style sheets). Change the CSS document and all webpages linked to this document will adapt the changes. For positioning items onto webpages at the right place boxes (divs)are used in combination with ids and classes. The main frame stays always in the middle of the screen due next used code:

```
#middle_screen
        {
        position:absolute;
        width:1024px;
        height:718px;
        top:50%;
        left:50%;
        margin-top:-384px;
        margin-left:-512px;
        background-color:#CCC;
        }
```

The result is the following:

This is the complete combination of boxes to get everything on the right place:




To upload the dimensions of a 3D object and pictures for texturing a form was used. This form is connected by a PHP script with the database.

### 5.2.2 WebGL based convertor

The Basic service make use of a WebGL to generate 3D content from the provided source material. With the coordinates a box is generated and afterwards the pictures (textures are paste on the each side of the box on the right place.

### 5.3.2 Testing and issues

All generated webpages were controlled with HTTP and CSS validator. All pages pass the test. The website can be tested online at www.ispn-system.org. One notice, Internet Explorer doesn't support WebGL. Therefore no 3D content can't be viewed in this browser. Other browsers are no problem if you got an updated version of them.

## 5.3 Implementation and testing WebGL part3D convertor

# CHAPTER VI

# CONCLUSION

Different conclusion each on different areas can be made after running this dissertation. Let's have an overview of the different areas and their specific conclusions.

## 6.1 Conclusion survey

The conducted survey consisted of two parts, a survey done before the project started and another after the finished project was finished. From the first survey we've learned that different categories involved in what we can called "Different stages of 3D visualization for commercial websites", have different opinions about the sense of 3D for commercial use. First the manufacturers, which were not that great in number but they gave some valid information. Seen afterwards big companies (> 10.000 people workforce) are not the ones needed to setup a system like ISPN, neither to get involved in the making of a 3D convertor. Mainly they got their own ideas of how everything has to be worked out and has enough money for doing it that way also. Comment of Inge Plochaet indicated this enough. So a first conclusion is:

- **Better to get involve smaller companies with ISPN system and 3D convertor**

The graphic designer and website developer group is the one which was the most enthusiastic about the ISPN project combined with 3D visualization. They want to use it as fast as possible. This is also the group (or at least their clients) which believe the most in the use of 3D visualization as an extra motivation to get people buying extras, especially when combined with an ordering system. 80% of this group had problems to get decent footage to work with. 90% of them stated that their clients are aware of sales boost 3D could give. 100% found the ISPN system useful. So a second conclusion is:

- **Graphic designers and website developers have a big need for useable 3D content and an ISPN system or likewise. So there's a demand.**

The academic survey goal was in the first place to get useful extra input how to conduct the Msc project and to know if all objectives could be achieved. For the latter 60% of the inquiries did thought all the objectives couldn't be reached due the complexity of the system. On the other hand objectives were well described and some inquiries did come up with extra ideas or solutions. This input needed to streamlined to be useful for the system on a later time, for example in a second release of the system. A third conclusion is:

- **Input and opinions of academics are an added value in developing the system.**